PROGRAM

A variety of modern electronic systems depend critically on precise timing or an ultra-stable frequency reference. The clocks and oscillators in such systems must therefore be characterized carefully. This seminar focuses on common methods of measuring and interpreting oscillators and clock performance and how these results affect overall system performance.

Among other topics you will learn:

1. How to make frequency, time, synchronization, phase noise, and jitter measurements.
2. How to interpret and analyze data.
3. How to specify and choose an oscillator: theory of operation, properties, accuracy and noise limitations, and costs of common oscillators from quartz to atomic standards.
4. Jitter analysis and how to compute jitter from phase noise and frequency instability.
5. Common measurement mistakes and how to avoid them.
6. How to establish traceability for calibrations and measurements.
7. How to use GPS and other resources to obtain synchronization and/or accurate time.

AUDIENCE

This seminar is a must for mathematicians, engineers, metrologists, scientists, laboratory technicians, educators, managers and planners who need to know about precise timing, low phase-noise oscillators or amplifiers, calibrations, or traceability. It is particularly appropriate for those who are or might be responsible for specifying or measuring oscillator or timing performance.

LOCATION

Millennium Harvest House Hotel
1345 28th Street
Boulder, CO 80302
Phone: (303) 443-3850
Fax: (303) 443-1480

LABORATORY TOUR

Tour NIST's Laboratory Facilities on Thursday, June 19 from 2-4 P.M. (Note that this tour is subject to cancellation depending on the Nation's security status at the time of the meeting.)

AGENDA

Basic Definitions of Terms
•Frequency, Time, Phase, Accuracy, Stability, Noise, Jitter, Standards, Calibration, Traceability, Certification
•Time and Frequency Fundamentals

Measurement Methods and Analysis of Oscillators, Synchronization Systems, and Phase-locked Loops
•Frequency-Domain Performance: PM and AM Noise Measurements of Oscillators and Amplifiers
•Time-Domain Performance: Allan Variances, Total Estimators, and other Time and Frequency Variances
•Characterizing Clock Jitter

How to Collect, Analyze, and Interpret Real Data
•Measurement Techniques and Analysis Examples
•How to Use Stability Analysis Software (included in fee)

What You Need to Know about Oscillators and Frequency Standards
•Quartz Crystal Resonators and Oscillators
•Atomic Standards: Rubidium and Cesium
•Comparing Laboratory and Commercial Frequency Standards

Testing Oscillators and Frequency Standards
•Measurements and Instrumentation Requirements
•Demonstrations of Lab Measurements
- *•Time Stability*
- *•Frequency Stability*
- *•Phase Noise and Spectral Purity*
- *•Jitter Analysis*

Using the Global Positioning System (GPS) as a Transfer Standard
•GPS Time: What is it? How is it used?
•Time and Frequency Transfer Using Common-view GPS
•Carrier-phase Common-view Time Transfer Using GPS
•Limitations of GPS Synchronization
•Alternative Synchronization Techniques

Advanced Time and Frequency Applications
•Two-way Satellite Time and Frequency Transfer
•Synchronization in Telecommunications Systems, Internet Time Service, Network Time Protocols
•Future Frequency, Time, and Synchronization Standards
•Optical Standards, Laser Cooling, and Optical Frequency Division
•Emerging Applications and Future User Requirements

LODGING

For hotel reservations, please contact:

Millennium Harvest House Hotel Boulder
Phone: (303) 443-3850
Fax: (303) 443-1480

Room Rate: $93 + 9.65% tax
Please mention "NIST Time and Frequency Seminar" when you call the hotel.

Make your room reservation on-line at:
http://www.millenniumhotels.com/mc/hotel_description.jsp?hotelId=117
Use the rate code 1505.

REGISTRATION

Check-in will be held on Monday, June 16th from 8:00 - 8:45 am at the Millennium Harvest House Hotel.

Seminar Registration Fee: $1400

Fee includes lecture notes, continental breakfasts, 3 lunches, refreshments and one reception. Class size is limited.

Requests for cancellation and refund must be received in writing by **June 9, 2003**.

REGISTRATION DEADLINE
International Registrants: June 2, 2003
U.S. Domestic Registrants: June 9, 2003

Three ways to register:
1. Complete the registration form and mail it along with your registration fee to:

NIST/Finance Division
100 Bureau Drive, Stop 3751
Administrative Building (101), Room A822
Gaithersburg, MD 20899-3751 USA

2. Fax the completed form along with proof of payment to:

(303) 497-5208

3. Or, register on-line at:
http://www.nist.gov/public_affairs/confpage/blconf.htm

REGISTRATION FORM

Last Name_____

First Name_____

Company_____

Address_____

City_____

State_____ Zip Code_____

Country_____

Phone_____

Fax:_____

Email:_____

Require Handicap Services?_____

Date of Birth_____

Place of Birth_____

Registration fee: **$1400**

Amount Remitted: $_____

Make checks payable to:
2003 NIST Time and Frequency Seminar
(Checks accepted from U.S. banks only)

Method of payment:

☐ Check _____

☐ *Purchase Order #_____

☐ *Training Form _____

☐ Visa ☐ MC ☐ AMEX ☐ Discover

Card #_____

Expiration date:_____

_____
Signature (required for all charges)

The information provided in this registration form will be used for the following purposes:

- to process your payment
- to create a conference name badge
- to publish in a participants list for this conference
- to compile mailing lists for future conferences.

☐ Please check here if you do not want your information published in the participants list or conference mailing list.

*Original PO/Training Form must be submitted at check-in.

Request for cancellation and refund must be received in writing by June 9, 2003.

CONTACT INFORMATION

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NIST – Time and Frequency Division
325 Broadway, Div 847
Boulder, CO 80305 USA

http://tf.nist.gov/seminars

Seminar Arrangements:
Wendy Ortega
Conference Program Manager

Phone: (303) 497-4500
Fax: (303) 497-5208
ortegaw@boulder.nist.gov

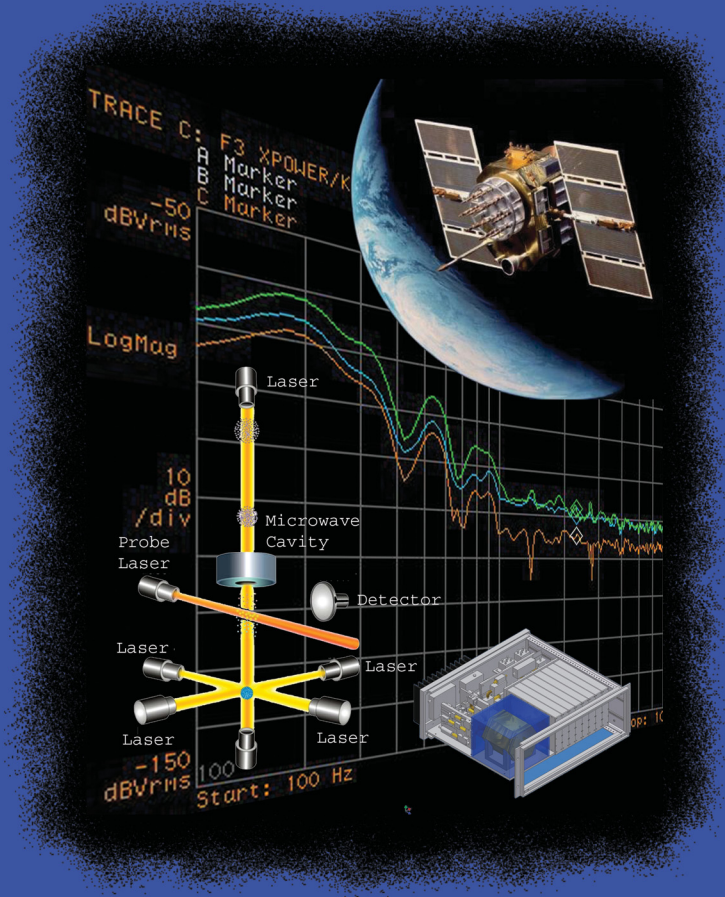
Boulder area maps, directions
to airport and information:

http://www.boulder.nist.gov/maps.htm

REGISTRATION DEADLINE
International Registrants: June 2, 2003
U.S. Domestic Registrants: June 9, 2003

NOTE: Date and Place of Birth are required in order for any non-DoC personnel to attend <u>any</u> event on the DoC campus. If the requested information is not provided for security to accomplish background checks, access to the site will be denied.

http://www.nist.gov/public_affairs/
confpage/blconf.htm



28th Annual NIST Time and Frequency Metrology Seminar

June 16-19, 2003
Boulder, CO

NIST
National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce